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CORPORATE CASH HOLDINGS: EVIDENCE FROM SWITZERLAND

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Abstract

This paper investigates the determinants of a broad sample of Swiss non-financial firms' cash holdings between 1995 and 2004. The median Swiss firm holds almost twice as much cash and cash equivalents as the median U.S. or U.K. firm. Our results indicate that asset tangibility and firm size are both negatively related to cash holdings and that there is a non-linear relationship between the leverage ratio and liquidity holdings. Dividend payments and operating cash flows are positively related to cash reserves, but we cannot detect a significant relationship between growth opportunities and cash holdings. Most of these findings, but not all of them, can be explained by the transactions and/or the precautionary motive. Dynamic panel estimation indicates that Swiss firms adjust their liquidity holdings only slowly towards an endogenous target cash ratio. Looking at the firms' corporate governance structures, we document a non-linear relationship between managerial ownership and cash holdings, indicating an incentive alignment effect and an opposing effect related to increasing risk aversion. Finally, our results suggest that firms in which the CEO simultaneously serves as the COB hold significantly more cash.

Keywords: Cash holdings, corporate governance, dynamic adjustment.

JEL classification codes: G32.

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1 Introduction

Swiss firms, on average, hold much larger cash reserves than firms in most other countries [1]. The median cash ratio of a sample of 156 Swiss non-financial publicly listed firms varies in a range between 10 percent and 15 percent over the period from 1995 to 2004. DITTMAR et al. (2003) compare the median cash ratio of firms from 45 countries, and only in seven countries does the median firm hold more cash than the median Swiss firm. However, there are not only significant differences in cash holdings across countries. Significant variation can also be seen between firms within countries. While differences in cash holdings between firms from different countries are strongly related to these countries' financing practices and/or legal structures (e.g., shareholder protection rights), OPLER et al. (1999) document that differences between firms within a country are largely attributable to fundamental firm characteristics (e.g., firm size, profitability, growth opportunities, and asset tangibility). Moreover, firm-level corporate governance structures seem to have an impact on the amount of cash reserves. For example, using a sample of U.K. firms, OZKAN and OZKAN (2004) document that managerial ownership, board composition, and ownership concentration influence cash holdings.

In a frictionless world a firm would not have to hold cash. There is no optimal cash level, and a firm could wait and immediately raise outside funds whenever internal funds are insufficient to fund projects. If cash flows are unexpectedly low, a firm can raise external funds at fair prices to keep operating and to invest in positive net present value projects. Assuming that there are no liquidity premium and no negative tax effects if a firm borrows money and accumulates liquidity, shareholders' wealth remains unchanged. Even if one believes that an optimal capital structure exists, it only applies to *net* debt, defined as debt minus cash. Cash is merely negative debt, and there is no optimal amount of cash. Changes in internal resources are the driving force behind changes in cash holdings, but it does not matter whether a firm uses internal resources to accumulate cash and/or repay debt (MYERS and MAJLUF, 1984; OPLER et al., 1999).

In reality, however, frictions will in fact cause cash holdings to matter. A firm with sufficient cash holdings will not have to forego positive net present value projects because of market imperfections, transaction costs, or asymmetric information. Moreover, cash holdings reduce the probability of financial distress. In contrast, cash may itself be part of the agency problem within firms, weakening market discipline and increasing the entrenched CEO autonomy. Managers can have incentives to hold large cash reserves in order to pursue their own objectives at the expense of shareholders (e.g., consumption of perquisites and/or inefficient investments). Given that the theoretical predictions are ambiguous, it remains an empirical question whether cash holdings can be explained by a precautionary or optimal financial planning motive rather than by managerial opportunism (FAULKENDER and WANG, 2006).

In this paper we discuss the motives to hold cash, and we derive testable hypotheses. Our empirical tests use an unbalanced panel of 156 publicly listed Swiss firms over the period from 1995 to 2004. Given the strong institutional differences, it is not clear from a theoretical point of view whether the U.S. results can be generalized and applied to other major markets. Therefore, our analysis with Swiss data provides an important robustness test [2]. We use fixed and random effects panel models to analyze the determinants of the cash ratio. Our results indicate that the amount of a firm's cash reserves is strongly related to leverage and asset tangibility and, to a lesser extent, to firm size, profitability, and payout policy. Extending the static model, we estimate the speed of adjustment towards an endogenous target cash ratio in a dynamic panel model. The estimated speed of adjustment coefficient for Swiss firms is between 0.35 and 0.5, implying that, ceteris paribus, the difference between the observed cash ratio and the target is reduced by 35-50 percent per year. Finally, we analyze the impact of corporate governance variables on cash holdings. Our results suggest that a higher percentage of managerial ownership leads to lower cash holdings, indicating reduced agency conflicts between managers and shareholders. In contrast, when managerial ownership becomes large (in absolute terms), cash holdings increase. We interpret this result as reflecting managers' risk aversion. Finally, CEO duality is associated with higher cash holdings.

The remainder of this paper is as follows. Section 2 discusses the different motives for cash holdings. The first part of section 3 describes the data and develops our main hypotheses. The second part of section 3 presents the results from standard and dynamic panel models. Section 4 discusses the results of simple cross-sectional regressions involving cash holdings and a set of corporate governance variables. Finally, section 5 concludes the paper.

2 Theoretical motives for cash holdings

As already discussed above, in perfect capital markets there is no reason for a firm to hold liquid assets. Therefore, capital markets frictions must explain why a firm might not regard external finance as a perfect substitute for internal finance. The literature on corporate cash holdings emphasizes two major motives for holding liquidity: (i) the transaction costs motive and (ii) the precautionary motive. The transaction costs motive recognizes that raising external funds involves fixed and variable costs. The fixed cost component induces a firm to raise external funds only infrequently and to hold cash as a (costly) buffer. Therefore, for a given amount of net debt, there is an optimal amount of cash to be raised. In contrast, the precautionary motive relates to information asymmetries, agency costs, and the opportunity costs of foregone investments. If the adverse selection costs of external finance and/or the costs of financial distress are excessively high, firms accumulate liquidity to meet unanticipated cash shortfalls and finance their positive net present value investments.

2.1 Transaction costs

In the presence of transaction costs, a value-maximizing firm evaluates the marginal costs and marginal benefits of cash holdings to determine an optimum (e.g., KEYNES, 1936). On the one hand, economies of scale for raising external funds encourage firms to hold cash as a buffer and avoid frequent external fund raising (LEE et al., 1996; KIM et al., 1998). On the other hand, the cost of holding liquidity is the lower pecuniary return. In the presence of transaction costs, one part of the benefits of holding liquid assets is that they can more easily be converted into cash, i.e., there is a liquidity premium, defined as the opportunity cost for holding liquid assets. Moreover, there is a tax disadvantage from a shareholder's point of view. If a firm holds liquid assets, the accrued interest income is taxed twice and shareholders could earn a higher pre-tax return from holding these securities directly (MASULIS and TRUEMAN, 1988).

The transaction costs motive leads to several predictions about a firm's cash holdings. For example, the existence of economies of scale suggests that smaller firms hold relatively more liquidity than larger firms. Another hypothesis builds upon the notion that one way to raise cash is through liquidation of assets (SHLEIFER and VISHNY, 1992). A firm whose assets can be cheaply converted into cash can raise funds at low cost by selling these assets. Therefore, firms with a high degree of asset specificity tend to have higher cash holdings. A related hypothesis is that larger firms are generally more diversified and can liquidate assets in non-core segments, allowing them to hold less liquidity (OPLER et al., 1999). Finally, a shorter cash conversion cycle implies better timing of incoming and outgoing payments, requiring smaller cash positions. In addition, firms with shorter cash conversion cycles tend to be diversified firms with multiple product lines, also suggesting that these firms hold less cash. In contrast, however, DELOOF (2001) argues that a longer cash conversion cycle reduces the need to hold liquidity because more receivables and inventories can quickly be converted into cash.

2.2 Information asymmetries and agency costs of debt

Information asymmetries

MYERS and MAJLUF (1984) suggest that asymmetric information between managers and investors makes external financing costly. In the presence of adverse selection costs, securities may be mispriced, and firms prefer internal over informationally sensitive external finance. If adverse selection costs become extreme, a firm may find it more profitable not to sell securities and even to forego investments. Therefore, it is valuable to build up financial slack (MYERS, 1984). This motive for holding cash can be subsumed under the precautionary motive (OPLER et al., 1999) or the financing motive (DELOOF, 2001).

There are two potential implications of the existence of adverse selection costs. If they are interpreted as an additional cost of raising capital, then a firm still faces a trade-off between the costs and the benefits of holding cash. In contrast, if one assumes that the costs of external financing are prohibitive, a firm will generally avoid financing investments with external capital and instead accumulate cash. In this case, however, there is no target cash level. If the costs of holding cash are incorporated (i.e., the low return earned on liquid assets and increasing agency cost), there is only an upper bound from which point onward it is too costly to hold more cash.

To avoid excessive adverse selection costs and being forced not to invest, firms with higher information asymmetries hold more cash. Most important, firms whose values are mainly determined by growth options should have larger cash reserves to avoid foregoing some profitable investment opportunities. Growth opportunities represent intangible assets, and this implies that growth firms incur higher bankruptcy costs and that their value decreases sharply in financial distress or bankruptcy (e.g., WILLIAMSION, 1988; HARRIS and RAVIV, 1991; SHLEIFER and VISHNY, 1992). This notion also supports the hypothesis that firms with high research and development expenses have more incentives to avoid financial distress and therefore tend to hold larger amounts of cash. In addition, transaction costs will be lower for firms that are more closely monitored and have better access to the capital markets. External monitoring is possibly stronger for dividend-paying firms, and it might be easier for them to raise external funds. Alternatively, they could cut dividends, implying lower cash holdings. A competing hypothesis, however, holds that dividend payers have an incentive to avoid a cash squeeze because they are particularly reluctant to cut dividends (BRAV et al., 2005). Moreover, larger firms exhibit less pronounced information asymmetries (and lower adverse selection costs) than smaller firms do (BRENNAN and HUGHES, 1991; COLLINS et al., 1981). Smaller firms also face higher costs of external financing than larger ones because they are more likely to face borrowing constraints (WHITED, 1992; FAZZARI and PETERSON, 1993) and because they cannot exploit the scale economies resulting from a substantial fixed cost component of security issuance costs (KIM et al., 1998). Assuming that firm size is an inverse proxy for both the degree of information asymmetries and the cost of external financing, smaller firms can be expected to hold a greater amount of cash than larger firms. This notion is also justified by the assumption that larger firms are more likely to be diversified and are therefore less likely to experience financial distress (TITMAN and WESSELS, 1988).

Agency costs of debt

Agency costs of debt arise when the interests of shareholders differ from those of debtholders and/or when diverging interests exist between various classes of debtholders. Moral hazard problems make it difficult and expensive for highly leveraged firms to raise additional debt and/or renegotiate existing debt contracts to prevent bankruptcy. JENSEN and MECKLING (1976) argue that these firms have strong incentives to engage in asset substitution, making debt more expensive both in terms of the required yield and in terms of the covenants attached to the debt. Moreover, highly leveraged firms will likely suffer from MYERS' (1977) underinvestment problem, where the old shareholders have little incentive to provide additional equity capital even when a firm has profitable investment projects because the cash flows from these investments disproportionately accrue to the creditors. In both cases agency costs of debt are so high that firms cannot raise funds and forego profitable investment projects.

A simple way to avoid agency costs of debt is to choose a low level of leverage (PARRINO and WEISBACH, 1999). However, OPLER et al. (1999) suggest that firms with valuable investment opportunities, for which the cost of raising external funds can even be prohibitive, tend to hold more cash because the cost of being short of funds is higher. Accordingly, holding the degree of information asymmetry between managers and investors constant, firms with high investment opportunities (e.g., as proxied by the market-to-book-ratio) tend to hold more cash because the costs they incur in financial distress (agency costs of debt) are higher. These firms invest a lot, and therefore they hold more cash in order to pay for their investment expenditures.

2.3 Agency costs of managerial discretion

In addition to shareholder-bondholder conflicts, the conflicts of interest between shareholders and managers can also relate to a firm's cash holdings. One reason for managers to hold excess cash is that they are risk-averse (FAMA and JENSEN, 1983; STULZ, 1988). Managers are not fully diversified because they cannot divide their human capital, and therefore more entrenched managers hold excess cash to avoid market discipline. JENSEN (1986) argues that in the presence of managerial discretion, managers have incentives to hold large amounts of cash so that they can have more flexibility to pursue their own objectives. Cash allows management to make investments that the capital market would not be willing to finance. Since excess cash holdings allow self-serving managers to avoid the discipline of the capital markets, investing in cash increases the costs of outside financing and can have detrimental effects on firm value.

To analyze the relationship between agency costs of managerial discretion and cash holdings, empirical studies must use variables that indicate to what extent a firm's management is disciplined (or not). For example, firm size is usually viewed as a takeover deterrent; hence, larger firms tend to hold more cash. OPLER at al. (1999) suggest that firms with low debt levels tend to hold more cash because a low leverage ratio makes the firm less subject to market monitoring. Similarly, STIGLITZ (1985) argues that there is little incentive for small shareholders to monitor managers because the costs of monitoring will likely outweigh the benefits. Therefore, one could hypothesize that firms with dispersed shareholders hold larger amounts of cash. In contrast, the existence of a large shareholder makes a takeover or a proxy contest a credible threat (SHLEIFER and VISHNY, 1986). When a firm has a controlling shareholder, another aspect is that the controlling party can appropriate private benefits not shared by the other shareholders (BARCLAY and HOLDERNESS, 1989; DYCK and ZINGALES, 2004). OZKAN and OZKAN (2004) argue that large shareholders have an incentive to increase the funds under their control to consume private benefits at the expense of minority shareholders, e.g., by holding large cash reserves. A closely related hypothesis is that firms with deviations from the one share-one vote principle potentially expropriate minority shareholders, and one way to do so is to hold excess liquidity.

JENSEN and MECKLING (1976) suggest that managerial ownership reduces the incentives for value-destroying actions, implying a negative relationship between managerial shareholdings and the amount of cash reserves. At the same time, however, managers are risk-averse and less than fully diversified, and they protect themselves from outside pressure by holding excess cash. In fact, OZKAN and OZKAN (2004) document that the relationship between managerial ownership and cash holdings is U-shaped. They explain this observation by the opposing influences of incentive alignment and entrenchment effects.

Another aspect that has increasingly gained interest in the corporate governance literature is the structure of the board of directors, such as board composition, board independence, board size, and the effectiveness of board work (e.g., HERMALIN and WEISBACH, 2003). For example, one may hypothesize that firms with more outside directors on the board are likely to experience a reduction in the agency costs of external finance and hold less cash. Another aspect of outsider- vs. insider-dominated boards of directors is whether the CEO acts simultaneously as the COB. BEINER et al. (2006) document that firms that work under CEO duality elect significantly fewer outside directors into the board, indicating potential conflicts within the boardroom. Therefore, a testable hypothesis is that firms with dual CEOs also tend to hold larger cash reserves. Furthermore, JENSEN (1993) and LIPTON and LORSCH (1992) argue that large boards are less effective than small boards, presuming that the emphasis on politeness and courtesy in boardrooms is at the expense of truth and frankness. When boards become too big, agency problems (e.g., director free-riding) increase, and the board becomes more symbolic and neglects its monitoring and control duties. Therefore, given YERMACK's (1996) empirical finding that larger board size leads to lower firm valuation, a testable hypothesis is that firms with larger boards encounter larger agency costs of external finance and hold more cash.

3 Cash holdings of Swiss firms

3.1 Data description and testable hypotheses

Our sample targets all 227 firms in the Swiss Performance Index (SPI) as of May 2005. We exclude financial institutions because their balance sheet is affected by exogenous factors, i.e., specific rules and regulations according to regulatory laws. In addition, we could not collect the necessary data for many of the smaller firms in the SPI. These adjustments leave us with an unbalanced panel of 156 firms over the period from 1995 to 2004.[3] The data are taken from the Datastream and Worldscope databases. Table 1 shows the descriptive statistics of the variables we use in our tests, and table 2 exhibits the corresponding correlation matrix. All variables are truncated at the 1 percent and 99 percent levels.

Table 1: Descriptive statistics

Variable	Mean	Max.	0.75 quantile	Median	0.25 quantile	Min.	Standard deviation	N
CASH	0.1480	0.7195	0.1962	0.1140	0.0587	0.0038	0.1259	1299
CASHN	0.2126	2.5657	0.2440	0.1286	0.0623	0.0039	0.2798	1299
SIZE	2710	123851	964	299	100	12	11680	1283
LSIZE1	12.7598	18.6346	13.7791	12.6072	11.5089	9.3780	1.7783	1283
LSIZE2	165.9716	347.2478	189.8642	158.9406	132.4550	87.9477	47.6270	1283
LEV	0.2511	0.6850	0.3544	0.2417	0.1296	0.0001	0.1505	1271
DIVDUM	0.7462	1.0000	1.0000	1.0000	0.0000	0.0000	0.4354	1312
POR	0.4026	2.8750	0.4581	0.3308	0.2344	0.0143	0.3262	911
DIVYIELD	0.0232	0.0831	0.0315	0.0218	0.0143	0.0007	0.0124	935
PROFIT	0.0511	0.2713	0.0867	0.0511	0.0217	-0.3204	0.0723	1309
OPCFL	0.0812	0.2859	0.1167	0.0841	0.0474	-0.2521	0.0687	1267
MTBR	2.2465	13.6703	2.6933	1.4953	0.9829	0.3840	2.0798	1239
RDDUM	0.4232	1.0000	1.0000	0.0000	0.0000	0.0000	0.4942	1354
1/ZSCORE	0.3360	1.5099	0.4501	0.2931	0.1577	0.0013	0.2455	1152
1/ZSCORE2	0.3071	1.2206	0.3982	0.2681	0.1478	0.0013	0.2261	1150
TANGF	0.3643	0.9426	0.4844	0.3381	0.2001	0.0317	0.2071	1297
TANGR	0.1942	0.4703	0.2594	0.1889	0.1172	0.0088	0.1023	1291
TANGI	0.1694	0.4593	0.2379	0.1721	0.0868	0.0031	0.1029	1288
CASHCC	135	605	171	124	73	-1	89	1156

This table shows a data description of 156 Swiss non-financial firms over the period from 1995 to 2004. All firm-specific variables are explained in section 3.1 and are truncated at the 1 percent and 99 percent levels. N denotes the number of firm-year observations.

Table 2: Correlation matrix

	CASH	LNCASHN	LSIZE1	LEV	DIVYIELD	PROFIT	OPCFL	MTBR	RD	1/ZSCORE	1/ZSCORE2	TANGF	TANGR	TANGI	CASHCC
CASH	1.00														
LNCASHN	0.92	1.00													
LSIZE1	0.17	0.21	1.00												
LEV	-0.46	-0.50	-0.10	1.00											
DIVYIELD	-0.04	-0.06	-0.35	0.04	1.00										
PROFIT	0.07	0.11	0.18	-0.15	-0.10	1.00									
OPCFL	0.13	0.16	0.10	-0.21	-0.01	0.50	1.00								
MTBR	0.13	0.15	0.42	-0.04	-0.45	0.51	0.24	1.00							
RD	0.20	0.18	0.30	-0.07	-0.34	0.12	0.04	0.38	1.00						
1/ZSCORE	-0.35	-0.39	-0.28	0.74	0.28	-0.40	-0.30	-0.45	-0.21	1.00					
1/ZSCORE 2	-0.40	-0.44	-0.27	0.76	0.27	-0.40	-0.29	-0.44	-0.22	0.99	1.00				
TANGF	-0.41	-0.43	-0.32	0.27	0.20	-0.26	0.00	-0.31	-0.26	0.39	0.44	1.00			
TANGR	-0.07	0.00	0.01	-0.13	-0.07	0.22	-0.08	0.23	0.07	-0.28	-0.30	-0.58	1.00		
TANGI	-0.27	-0.21	-0.14	0.07	-0.04	0.11	-0.15	-0.02	0.10	-0.01	-0.06	-0.37	0.362	1.00	
CASHCC	-0.03	-0.03	0.37	0.01	-0.29	0.09	-0.05	0.20	0.58	-0.07	-0.10	-0.29	-0.01	0.43	1.00

This table presents Pearson's correlation coefficients calculated with the values of the sample of 156 Swiss non-financial firms over the period from 1995 to 2004. All variables are explained in section 3.1 and truncated at the 1 percent and 99 percent levels.

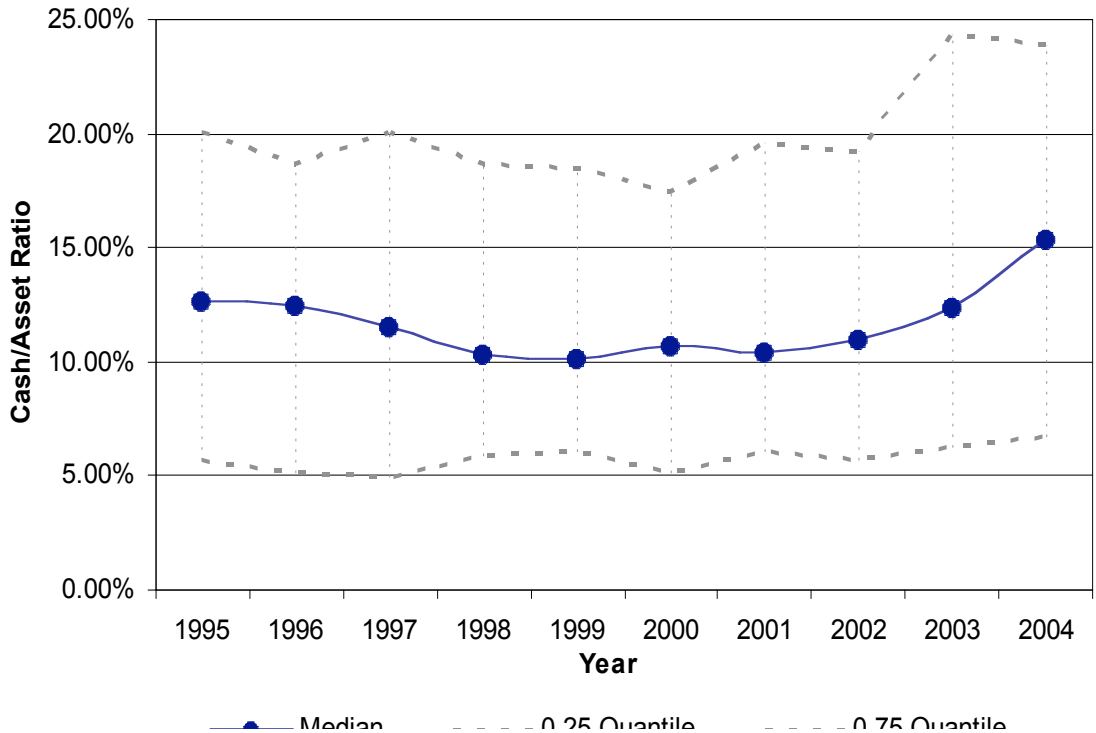
Cash ratio

In an early study KESTER (1986) compared the cash holdings of Japanese and U.S. firms. The average U.S. firm held only 8.6 percent of its assets in cash in 1983, whereas in Japan the average was 18.7 percent. More recently, DITTMAR et al. (2003) analyzed a sample of more than 11'000 firms from 45 countries. Looking at the median cash ratios, they document a wide cross-country dispersion. In 1998, the median cash ratios ranged from 0.3 percent in Kenya to 29.6 percent in Egypt. PINKOWITZ and WILLIAMSON (2001) explain the difference between Japanese and U.S. cash holdings by the monopoly power of Japanese banks that persuade firms to hold large cash reserves. In contrast, DITTMAR et al. (2003) argue that the differences in cash holdings are attributable to differences in the corporate governance structures across countries. They show evidence that firms in countries with weak minority shareholder protection hold up to twice the cash reserves of firms in countries with strong protection rights of small shareholders. In contrast, however, the findings of KALCHEVA and LINS (2004) do not support the prediction that cash holdings are more valuable for firms in countries with underdeveloped financial markets. Similarly, HARFORD, MANSI, and MAXWELL (2004) report that U.S. firms with weaker shareholder rights tend to have smaller cash reserves. They explain their results with the fact that in the U.S. entrenched managers dissipate cash reserves (primarily on acquisitions) more quickly than managers in other countries.

Our data suggest that Swiss firms hold large amounts of cash. For example, in 2003 the 156 non-financial firms for which we have data available held almost 90 billion Swiss francs in cash and cash equivalents. At that time, their assets had an aggregate book value of 450 billion Swiss francs, i.e., almost 20 percent of their total assets represented liquidity. Figure 1 shows the median cash ratio of Swiss firms over the sample period from 1995 to 2004. The median Swiss firm holds 11.4 percent of its total assets as liquidity, whereas the median U.S. and U.K. firm holds 8.1 percent and 6.4 percent cash, respectively (DITTMAR et al., 2003). Hence, in an international comparison Swiss firms tend to hold high cash reserves. Given that Swiss firms

generally have close ties to banks (relationship banking), one could hypothesize that they should hold less cash. Bank monitoring decreases asymmetric information and the incentives for detrimental behaviour on part of the management, and these benefits could potentially eliminate cash hording. In contrast, however, using Japanese data PINKOWITZ and WILLIAMSON (2001) provide evidence that main banks encourage firms for which they act as the principal monitor to hold relatively high levels of cash, predominantly to benefit the bank itself. While we cannot rule out this explanation for our sample of Swiss firms, another explanation could be that firms had easy access to (both short- and long-term) bank debt as a means of financing with relatively low transaction costs. In fact, Swiss banks followed an easy credit policy during the last decade, and the total size of the Swiss credit market is large compared to Anglo-Saxon countries. For example, the total amount of bank credit granted to the industrial sector adds up to 41 percent of the Swiss gross domestic product, whereas for the U.S. and the U.K. the corresponding numbers are 32 percent and 29 percent, respectively. In contrast, the total value of bonds outstanding from non-financial companies amounts to merely 8 percent of the Swiss gross domestic product, as compared to 22 percent and 20 percent in the U.S. and the U.K., respectively [4]. A final explanation is based on the observation that Switzerland was not a booming economy during our sample period. In general, therefore, internal funds were sufficient to finance all capital expenditures, and the stable cash flows of many Swiss firms even allowed building up high cash reserves.

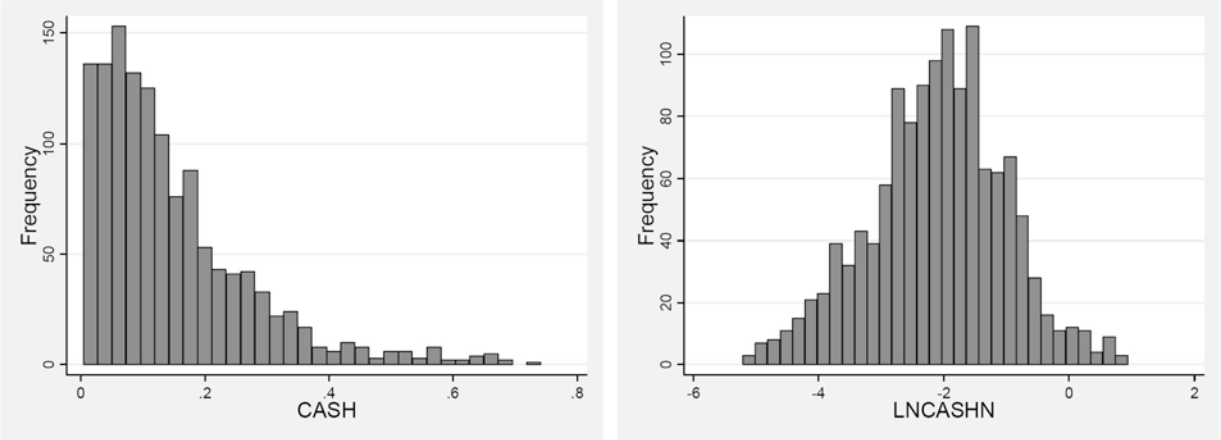
Figure 1: Median cash/asset ratio of Swiss firms (1995-2004)



The cash/asset ratio is defined as the ratio of cash and cash equivalents to book value of total assets. The graph exhibits the median cash ratio of Swiss non-financial firms as well as the 0.25 and the 0.75 quantile over the sample period from 1995 to 2005. The number of yearly observation varies between 88 and 156.

In literature there are two common ways to calculate the cash ratio. The first and most common method is to divide cash and cash equivalents by the book value of total assets (e.g., Kim et al., 1998). Other authors follow OPLER et al. (1999) and normalize cash with net assets, i.e., book value of total assets minus cash and cash equivalents. To provide widely comparable results, we use both approaches to calculate the cash ratio. By construction, the first ratio, labelled *CASH*, is lower than the second ratio, denoted as *CASHN*. In fact, the median value in our sample for *CASHN* is 12.9 percent, as compared to only 11.4 percent for *CASH* (see table 1)[5]. Three quarters of our Swiss firms have a cash ratio (*CASH*) below 20 percent, but there are firms in our sample that hold up to 90 percent of their assets as cash and cash equivalents. According to a Jarque-Bera test (JARQUE and BERA, 1980), both *CASH* and *CASHN* are not normally distributed. One way to alleviate the problems from non-normality in panel regressions is to use the natural logarithm of the ratio. As an example, figure 2 shows the histograms of *CASH* and *LNCASHN* together with the Jarque-Bera test statistic. Truncating the data at the 1 percent and 99 percent levels, the null hypothesis that *LNCASHN* is normally distributed cannot be rejected.

Figure 2: Histogram of CASH and LNCASHN



Jarque-Bera test statistic: 2559*** Jarque-Bera test statistic: 79.09***

Without outliers:
Jarque-Bera test statistic: 1082*** Jarque-Bera test statistic: 4.027

This figure shows the empirical distribution of the cash ratio for our sample of Swiss non-financial firms. *CASH* is defined as the ratio of cash and equivalents divided to total assets, and *LNCASH* is the natural logarithm of cash and equivalents divided by net assets (i.e., total assets minus cash). There are 1299 firm-year observations over the period from 1995 to 2004. The null hypothesis of the JARQUE-BERA (1982) test is that the cash ratio is normally distributed. ***, ** and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

Explanatory variables

JOHN (1993) presents evidence for firm-level determinants of cash holdings. Using a sample of 223 U.S. corporations, her results indicate that firms with higher costs of financial distress and higher cash flow volatility hold significantly more cash, while firms with higher leverage, higher growth rates, a longer cash conversion cycle, and more tangible assets hold less cash. While JOHN (1993) used time averages of all variables, more recent studies have applied panel regression methodology. For example, KIM et al. (1998) analyze a sample of 452 U.S. firms between 1975 and 1994 period, documenting that cash holdings increase with a higher market-to-book ratio and a higher cash flow volatility. Their results also reveal that cash holdings decrease with firm size, leverage, the length of the cash conversion cycle, and the probability of financial distress. Finally, they report a significant relationship between measures of future economic conditions and cash holdings, implying that firms accumulate cash so they can undertake future investment opportunities. OPLER et al. (1999) also employ a large sample of U.S. firms and document similar results. FAULKENDER (2004) analyzes small U.S. firms and reports that the determinants of cash holdings are somewhat different. Most important, he finds that small companies tend to hold more cash as their leverage increases, possibly because they have limited access to the capital markets [6].

Several studies have recently presented evidence from outside the U.S. For example, using a panel of U.K. firms, OZKAN and OZKAN (2004) confirm previous findings for the U.S. KYTÖNEN (2005) and GARCÍA-TERUEL and MARTÍNEZ-SOLANO (2004) analyze Finnish and Spanish firms, respectively, documenting that firm size, growth opportunities, cash flows, leverage, dividend policy, and the probability of financial distress impact cash holdings. FERREIRA and VIL-ELA (2004) investigate firms from the twelve EMU countries. They report that cash holdings are positively affected by growth opportunities and cash flows, whereas asset liquidity, leverage, bank debt, and firm size negatively impact cash holdings. Finally, using a sample of Belgian firms DELOOF (2001) documents that a firm's intragroup relations influence the need for liquidity.

We use a broad set of firm-specific variables to explain corporate cash holdings. Most predictions are ambiguous and allow different testable hypotheses. Our first explanatory variable, firm size, labelled *LSIZE1*, is measured as the natural logarithm of the market value of a firm's equity (in thousand Swiss francs) in 2004. The median firm in our sample has a market capitalisation of CHF 300 million. Alternatively, we use the natural logarithm of a firm's total assets to measure firm size, labelled *LSIZE2*. The expected relationship between firm size and cash holdings is ambiguous. On the one hand, in the presence of scale economies it is relatively cheaper for large firms to issue securities (BARCLAY and SMITH, 1995). In addition, large firms exhibit fewer information asymmetries and face lower costs of external financing than small firms (BRENNAN and HUGHES, 1991; FAZZARI and PETERSEN, 1993). OZKAN and OZKAN (2004) argue that large firms hold less cash because they are more likely to be diversified and, hence, less likely to experience financial distress (TITMAN and WESSELS, 1988). Therefore, our first hypothesis is:

Hypothesis 1a: Cash holdings are positively related to firm size.

On the other hand, larger firms were presumably more successful, hence, they have been able to accumulate higher cash reserves (OPLER et al., 1999). Furthermore, firm size can be regarded as a takeover deterrent. Managers of large firms have more discretionary power to hold excess cash without fearing a potential takeover. Because of the underdeveloped Swiss takeover market, the relevance of this hypothesis seems negligible. Nevertheless, an alternative hypothesis is:

Hypothesis 1b: Cash holdings are negatively related to firm size.

Leverage, labelled *LEV*, is measured as a firm's total debt (short- and long-term debt) divided by total assets. This measure only includes interest-bearing liabilities (RAJAN and ZINGALES, 1995). The leverage of the median firm in our sample is 24 percent, but a few firms in our sample are over-indebteded or without debt at all. Several arguments in the literature suggest that higher leverage should reduce cash holdings. In a pecking order world, debt grows when investment exceeds retained earnings and falls when investment is less than

retained earnings. Cash holdings follow an inverse pattern over time, in which cash decreases when investments exceed retained earnings, and vice versa. This relationship among cash holdings, debt, and investment suggests a negative relationship between leverage and cash holdings. In addition, firms with better access to the debt markets and/or bank loans have less need to hold cash. Finally, high-leverage firms are more subject to investor monitoring, implying limited managerial discretion and lower cash holdings. These arguments lead to the following hypothesis:

Hypothesis 2a: Cash holdings are negatively related to the leverage ratio.

In contrast, higher leverage increases the probability of financial distress and could therefore induce firms to hold more cash (OZKAN and OZKAN, 2004). Moreover, high leverage provokes MYERS' (1977) underinvestment problem, and holding excess cash minimizes the potential agency costs of debt. From a theoretical point of view, therefore, the predicted relationship between leverage and cash holdings is ambiguous, and thus, an alternative hypothesis is:

Hypothesis 2b: Cash holdings are positively related to the leverage ratio.

We use the ratio of fixed assets to total assets, denoted as *TANGF*, as a proxy for asset tangibility. The median firm in our sample has 34 percent of its assets invested in fixed assets. Firms with more tangible assets can be expected to hold less liquidity because tangible assets can be sold in the case of a cash shortfall. In addition, firms with more collateral encounter fewer problems to issue debt (TITMAN and WESSELS, 1988), and therefore they have less need to build up high cash reserves. To double-check our results, we also compute the ratio of receivables to total assets (*TANGR*) and the ratio of inventory to total assets (*TANGI*). High values of the latter two variables indicate that firms can quickly convert assets into cash, e.g., by factoring the receivables. This leads to the following hypothesis:

Hypothesis 3: Cash holdings are negatively related to the firm's asset tangibility.

The cost of liquidation is higher for a firm that sells unique or specialized products (e.g., TITMAN, 1984). Accordingly, these firms should have an incentive to hold greater cash reserves. We follow JOHN (1993) and use the expenditures on research and development over sales, labelled *RD*, as a proxy for product uniqueness and the potential cost of financial distress. For firms without declaration, *RD* is assumed to be zero. Alternatively, we use a dummy variable, *RDDUM*, taking on the value of one if a firm's reported expenditure on research and development is greater than zero for a given year, and zero otherwise. Only 42 percent of the firms in our sample explicitly state that they invest in research and development activities. Research and development expenses are a form of investment in which information asymmetries are most important. Hence, we have:

Hypothesis 4: Cash holdings are positively related to the firm's research and development expenditures.

We use two measures for profitability. First, *PROFIT* is defined as the operating profit divided by total assets. Second, *OPCFL* is computed as the ratio of operating cash flow to total assets. Both variables are strongly correlated, and their descriptive statistics closely resemble each other. The theoretical predictions with regard to cash holdings are again ambiguous. On the one hand, in a pecking order world more profitable firms use their profits to build up liquidity (financial slack) and, hence, they tend to hold more cash (OPELR et al., 1999; FERREIRA and VILLELA, 2004). On the other hand, profits provide an immediate source of liquidity. If cash and profits are substitutes (or if firms use profits to repay debt), there should be a negative relationship (KIM et al., 1998). This leads to two competing hypotheses:

Hypothesis 5a: Cash holdings are positively related to profitability.

Hypothesis 5b: Cash holdings are negatively related to profitability.

We use two different measures for a firm's dividend payments. First, we simply differentiate if a firm pays dividends by using a dummy variable, *DIVDUM*, that takes a value of one if the firm pays dividends in the given year, and zero otherwise. Second, we use the dividend yield, denoted as *DIVYIELD* and computed as the dividend per share divided by the year-end stock price. As shown in table 1, 75 percent of the firms in our sample are dividend payers. The median dividend yield is only 2.18 percent. One hypothesis rests on the notion that dividend paying firms are better monitored and can raise funds at lower costs. The possibility to reduce dividend payments in case of a liquidity shortage also justifies lower cash holdings by dividend paying firms. In addition, the observation that a firm pays dividends may be the result of better corporate governance practices, implying that dividend payers hold less cash. Therefore, one hypothesis is:

Hypothesis 6a: Cash holdings are positively related to dividend payments.

It is equally reasonable to argue, however, that dividend payers are particularly reluctant to omit dividends and tend to hold larger amounts of cash (OZKAN and OZKAN, 2004). Hence, a competing hypothesis is:

Hypothesis 6b: Cash holdings are negatively related to dividend payments.

Following KIM et al. (1998), we use the inverse of an adjusted version of ALTMAN's (1968) Z-score (*1/ZSCORE*) as a proxy for the probability of financial distress. Compared to the original version of the Z-score, we exclude a measure of liquidity to avoid circularity, i.e., to avoid the fact that the cash ratio is explained by itself [7]:

$$Z\text{-}score = 3.3 \times \frac{EBIT}{Total\ assets} + 1.0 \times \frac{Sales}{Total\ assets} + 1.4 \times \frac{Retained\ earnings}{Total\ assets} + 0.6 \times \frac{Market\ value\ equity}{Book\ value\ total\ debt}.$$

A negative relationship between the probability of financial distress and cash holdings could simply reflect the fact that firms in financial distress are unlikely to have excess cash. Accordingly, KIM et al. (1998) predict a negative relationship between cash holdings and *1/ZSCORE*, implying that firms with a higher probability of financial distress hold less cash. A negative relationship could also be interpreted as support for JENSEN's (1986) notion that financial pressure reduces the agency costs of free cash flow.

Hypothesis 7a: Cash holdings are negatively related to the firm's probability of financial distress.

The direction of causality is ambiguous, however, and an equally plausible prediction is that firms with a high probability of financial distress attempt to hold high cash reserves in order to alleviate the consequences of financial distress.

Hypothesis 7b: Cash holdings are positively related to the firm's probability of financial distress.

To estimate a firm's growth opportunities, we use the market-to-book ratio, denoted as *MTBR*. As shown in table 1, the median value of *MTBR* in our sample is 1.5. Due to the expected losses that result from foregoing valuable investment opportunities, the cost of incurring a cash shortage is higher for firms with larger investment opportunities. Moreover, growth opportunities can hardly be liquidated in the case of bankruptcy and will lose most of their value. Therefore, firms with more growth opportunities have the incentive to hold more cash. Furthermore, growth firms are characterised by a higher degree of information asymmetry, and in a pecking order world it is more costly for them to raise external funds. All these arguments suggest a positive relationship between cash holdings and the market-to-book ratio.

Hypothesis 8a: Cash holdings are positively related to growth opportunities.

In contrast, however, growth firms may simply not have sufficient cash flows that they can accumulate. If the market-to-book ratio is viewed as a proxy for future growth opportunities and information asymmetries are held constant, the predictions that relate to the pecking order theory are ambiguous. Internal resources are the first sources of funds, hence, this implies a negative relationship between cash holdings and the market-

to-book ratio (OPLER et al., 1999). Therefore, the pecking order theory is consistent with both a positive and a negative relationship between the market-to-book ratio and cash holdings. Viewed from an agency perspective, entrenched managers of firms with poor investment opportunities are expected to hold higher cash reserves to invest, even if the net present value of the available projects is negative (FERREIRA and VILELA, 2004). Therefore, an alternative testable hypothesis is:

Hypothesis 8b: Cash holdings are negatively related to growth opportunities.

The final variable we use to explain cash holdings is the length of the cash conversion cycle, denoted as *CASHCC*. This variable is defined as [8]:

$$CASHCC = \frac{Receivables}{Sales} \times 360 + \frac{Inventories}{Cost\ of\ sales} \times 360 + \frac{Accounts\ payable}{Total\ operating\ expensures}.$$

The median length of the cash conversion cycle of Swiss firms is 124 days, as shown in table 1. As discussed in section 2 above, one could hypothesize a negative or positive relationship between the length of the cash conversion cycle and the cash ratio. On the one hand, a shorter cash conversion cycle implies better timing of cash flows, justifying smaller cash positions. On the other hand, a longer cash conversion cycle implies more receivables and inventories that could quickly be converted into cash. Accordingly, there are two competing hypotheses:

Hypothesis 9a: Cash holdings are negatively related to the length of the cash conversion cycle.

Hypothesis 9b: Cash holdings are positively related to the length of the cash conversion cycle.

3.2 Results of panel regression tests

Table 3 presents the estimation results of our baseline panel regression model, where *CASH* is the dependent variable. For each specification we report the results from both fixed effects and random effects regressions. The fixed effects estimator focuses on the within dimension of the data (i.e., differences within firms), whereas the random effects estimator also uses the between dimension of the data (i.e., differences between firms). To distinguish between fixed and random effects, we report a HAUSMAN (1978) test statistic for each specification. The null hypothesis is that the fixed and random effects estimators do not differ. Rejection of the null hypothesis is usually interpreted as evidence for the presence of fixed effects. All models include additional year dummies to control for variables that are constant across firms but that evolve over time. The combined time-fixed and firm-fixed effects model eliminates an omitted-variables bias arising both from unobservable variables that are constant over time and from unobservable variables that are constant across firms. To save space, we omit reporting the corresponding coefficients in table 3. All variables are again truncated at the 1 percent and 99 percent levels. The standard errors of the estimated coefficients are corrected for heteroscedasticity using the WHITE (1980) methodology.

Instead of discussing each specification in detail, we provide an overview of our most important results that are robust across all regression models. Our first result is that there is a negative relationship between firm size (*LSIZE1* and *LSIZE*2) and cash holdings (Hypothesis H1b). This observation is consistent with the proposition that it is relatively cheaper for larger firms to raise external funds. The negative coefficient coincides with previous findings from the U.S. (e.g., OPLER et al., 1999; FAULKENDER, 2004) and Belgium (DELOOF, 2001). In contrast, this negative relationship has not been reported for a cross-country EMU sample (FERREIRA and VILELA, 2004) and samples of Finnish (KYTÖNEN, 2005), Spanish (GARCÍA-TERUEL and MARTÍNEZ-SOLANO, 2004), and U.K. firms (OZKAN and OZKAN, 2004; GUNEY et al.,

2003). Our result does not support the notion that managers of large firms have more discretionary power over investments and financial policies, inducing them to hold a greater amount of cash.

A second result is the negative relationship between leverage (*LEV*) and cash holdings (Hypothesis 2a), as previously shown by OPLER et al. (1999), DELOOF (2001), FERREIRA and VILELA (2004), and OZKAN and OZKAN (2004) [9]. In contrast, this relationship is inconsistent with studies that looked at subsamples of small- and medium-sized firms (FAULKENDER, 2004; GARCÍA-TERUEL and MARTÍNEZ-SOLANO, 2004). The negative coefficient supports the pecking order theory, where cash holdings fall when investments exceed retained earnings and debt grows due to its lower adverse selection costs compared to equity. This result is also in line with the widely held presumption that higher leverage implies better monitoring and reduced managerial discretion. When we include a quadratic term of leverage, however, we find that the relationship between leverage and cash holdings is curvilinear. Specifically, the estimated coefficient on *LEV^2* is significantly positive. This result is consistent with the hypothesis that the probability of experiencing financial distress increases with leverage, inducing managers to hold more cash due to the precautionary motive. For highly leveraged firms, contingent claims analysis (MERTON, 1974) predicts that almost all firm value is in the hands of the debt holders. A small increase in cash reserves goes largely to increasing debt value (and not equity value) and implies that the probability of bankruptcy decreases [10].

Table 3: Panel regression results (I)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	FE	RE	FE	RE	FE	RE	FE	RE
	Dependent variable: *CASH*							
LSIZE1	-0.031***	-0.017***	-0.009	0.004				
	(-5.70)	(-5.08)	(-1.45)	(1.05)				
LSIZE2					-0.025**	-0.006	-0.022*	-0.007
					(-2.05)	(-1.47)	(-1.72)	(-1.61)
LEV	-0.148	-0.201**	-0.440***	-0.503***	-0.429***	-0.529***	-0.426***	-0.513***
	(-1.58)	(-2.41)	(-5.30)	(-6.46)	(-4.34)	(-6.20)	(-4.32)	(-6.10)
LEV^2	-0.001	0.042	0.502***	0.560***	0.491**	0.578***	0.514***	0.589***
	(-0.01)	(0.32)	(3.77)	(4.66)	(3.09)	(4.37)	(3.24)	(4.48)
TANGR	-0.569***	-0.549***						
	(-7.01)	(-9.19)						
TANGI	-0.597***	-0.575***						
	(-8.66)	(-10.63)						
TANGF	-	-	-	-	-	-	-	-

	0.569***	0.547***	0.370***	0.309***	0.409***	0.270***	0.436***	0.288***
	(-12.77)	(-14.5)	(-7.59)	(-10.31)	(-7.67)	(-8.66)	(-7.90)	(-9.27)
RDDUM	-0.007	-0.007	0.001	-0.001				
	(-0.77)	(-0.91)	(0.13)	(-0.16)				
RD					0.181	0.295*	0.255	0.300*
					(0.80)	(1.88)	(1.17)	(1.85)
PROFIT	0.074	-0.032	-0.061	-0.158*	-0.031	-0.065		
	(1.20)	(-0.55)	(-0.83)	(-1.90)	(-0.27)	(-0.64)		
OPCFL							0.166**	0.168**
							(2.34)	(2.18)
DIVDUM	0.013*	0.013*	0.021**	0.020**				
	(1.85)	(1.90)	(2.66)	(2.68)				
DIVYIELD					0.402	0.463	0.445	0.442
					(1.05)	(1.27)	(1.19)	(1.22)
1/ZSCORE	-0.052*	-0.034						
	(-1.94)	(-1.43)						
MTBR	0.004	0.003	-0.003	-0.001	-0.001	0.001	-0.001	-0.000
	(1.47)	(1.3)	(-1.07)	(-0.56)	(-0.37)	(0.50)	(-0.22)	(-0.09)
CASHCC	0.048	0.033	-0.269***	-0.238***				
	(0.51)	(0.46)	(-4.08)	(-4.05)				
Constant	1.024***	0.848***	0.512***	0.343***	0.712***	0.413***	0.665***	0.411***
	(12.42)	(13.88)	(6.50)	(7.10)	(4.44)	(6.19)	(3.92)	(6.25)
R^2 within	0.470	0.464	0.254	0.242	0.241	0.223	0.275	0.260
R^2 between	0.563	0.633	0.266	0.371	0.255	0.363	0.272	0.346
R^2 overall	0.538	0.587	0.248	0.317	0.224	0.315	0.254	0.322
N	919	919	992	992	852	852	829	829
Groups	144	144	147	147	135	135	134	134
Hausman test		201.98***		-57.85		30.95**		8.65

This table presents the results from fixed effects (FE) and random effects (RE) panel regressions. All variables are truncated at the 1 percent and 99 percent levels. In all columns, *CASH* is the dependent variable; it is calculated as the ratio of cash and cash equivalents to total assets. All explanatory variables are explained in section 3.1. The last row shows the value of a HAUSMAN (1978) test statistic. In parentheses are the *t*-statistics and the *z*-statistics for the fixed effects and random effects estimators, respectively. Year fixed effects are included in all specifications. ***, ** and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively. Standard errors are corrected for heteroscedas-

ticity using the WHITE (1980) methodology. The coefficient of *CASHCC* is multiplied by a factor 1'000. N denotes the number of firm-year observations.

The coefficients of all proxy variables for asset tangibility (*TANGR*, *TANGI*, and *TANGF*) are estimated to be significantly negative (Hypothesis 3). This result is consistent with the notion that tangible assets can be sold if a cash shortfall occurs and that firms with more collaterals encounter fewer problems issuing debt. Moreover, we find mixed evidence for the hypothesis of a positive relationship between cash holdings (*PROFIT*) and profitability (Hypothesis 5a). There is no reliable evidence for a link between operating profits and cash holdings. However, if we estimate the model with operating cash flow (*OPCFL*) instead of operating profit, we document a significantly positive relationship. Accordingly, when profitability is proxied by cash flow measures, we are able to conclude that profitability does not substitute for cash. Firms use their profits to build up liquidity. This supports the notion of the pecking order theory and confirms the findings from other countries (e.g., OPLER et al., 1999).

We document a positive relationship between our dividend dummy variable (*DIVDUM*) and cash holdings (Hypothesis 6a). This result is consistent with the hypothesis that dividend payers are particularly reluctant to omit dividends and, therefore, hold larger amounts of cash (e.g., OZKAN and OZKAN, 2004). However, the relationship between dividend payments and cash holdings is not robust. The estimated coefficient of our alternative measure for dividend payments, the dividend yield (*DIVYIELD*), is not significant. In addition, in one regression model the coefficient on the inverse of ALTMAN's (1968) Z-score (*1/ZSCORE*) is estimated to be significantly negative (Hypothesis 7a). This result is in line with the empirical findings of KIM et al. (1998) for U.S. firms and can be explained by JENSEN's (1986) hypothesis that financial pressure reduces the agency costs of free cash flow [11]. Finally, there is some evidence for a negative relationship between the length of the cash conversion cycle (*CASHCC*) and cash holdings (Hypothesis 9a). This observation could be explained along DELOOF'S (2001) notion that a longer cash conversion cycle increases receivables and inventories that could easily be converted into cash.

We also document two negative results. Most important, and in contrast to previous empirical studies (e.g., FERREIRA and VILELA, 2004; OZKAN and OZKAN, 2004; OPLER et al. 1999; KIM et al., 1998), growth opportunities (as measured by *MTBR*) are estimated to be insignificant in all four regression models. This result is at odds with the theoretical predictions laid out in hypotheses 8a/b, suggesting either a positive or negative relationship. In particular, our findings cannot provide support for the pecking order theory. One explanation for the insignificant results is based on the differences in the institutional setting of the Swiss financial system. As discussed in section 3.1 above, the financial system of Switzerland is more bank-oriented than those of the U.S. or the U.K. In their role as financial intermediaries (and possibly even house-banks), banks have better possibilities to screen firms than markets do. With better monitoring the cash decision of firms in bank-oriented financial systems is supposedly less affected by the degree of information asymmetry.

Another explanation is based on the notion that the market-to-book ratio might proxy for information asymmetries and/or growth opportunities. In fact, the hypotheses with regard to the market-to-book ratio are not mutually exclusive; both effects could be at work and cancel each other out empirically. While our methodology cannot disentangle the opposing forces, at a minimum, our results cast some doubt on the importance of the pecking order for the liquidity planning of Swiss firms. On the one hand, firms with high growth opportunities also face high information asymmetries, suggesting a positive relationship between the market-to-book ratio and cash holdings. Moreover, the model predicts that firms with high cash flows will hold more cash, and our own results provide weak support for this hypothesis. Firms with high cash flows often have a high market-to-book ratio because these firms can be expected to be profitable in the future (SHYAM-SUNDER and MYERS, 1999) [12]. On the other hand, growth firms may simply not have sufficient cash flows that they can accumulate. Cash is the first source of funds, implying a negative relationship between cash holdings and the market-to-book ratio (OPLER et al., 1999). Therefore, the distinction between the competing hypotheses becomes blurry, potentially explaining our empirical results.

In addition, we do not find a strong relationship between the research and development expenditures and cash holdings (Hypothesis 4). This result could partially be explained by the fact that many firms in our sample did not disclose their R&D expenditures. We use *RD* and *RDDUM* as proxy for the costs of financial distress. Alternatively, the market-to-book ratio (*MTBR*) could also be interpreted as an appropriate proxy for distress costs (e.g., WILLIAMSION, 1988; HARRIS and RAVIV, 1991; SHLEIFER and VISHNY, 1992). In results not shown here we excluded the variables *RD* and *RDDUM* from the regression model, but the change of the estimated coefficient of *MTBR* is negligible and remains insignificant.

To test the robustness of our results, we use the logarithm of our alternative definition of the cash ratio cash (*LNCASHN*) as the dependent variable. Table 4 contains the estimation results. The estimated coefficient of the dividend dummy is only significant in one regression specification. Therefore, the relationship between dividend payments and cash holdings is not very robust and must be interpreted with due care. All other results remain qualitatively similar, and we omit a more detailed discussion.

Table 4: Panel regression results (II)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	FE	RE	FE	RE	FE	RE	FE	RE
	Dependent variable: *LNCASHN*							
LSIZE1	-0.309***	-0.104***	-0.145**	0.043				
	(-6.41)	(-3.95)	(-2.93)	(1.41)				
LSIZE2					-0.276**	-0.028	-0.244**	-0.034
					(-2.87)	(-0.76)	(-2.39)	(-0.92)
LEV	-0.410	-0.939	-2.616***	-3.042***	-2.469***	-3.264***	-2.426***	-3.195***
	(-0.60)	(-1.59)	(-4.40)	(-5.39)	(-3.45)	(-5.09)	(-3.37)	(-5.00)
LEV^2	-1.095	-1.027	2.508**	2.774**	2.609**	2.808**	2.689**	2.993***
	(-0.93)	(-0.96)	(2.39)	(2.82)	(2.11)	(2.53)	(2.15)	(2.67)
TANGR	-4.206***	-3.937***						
	(-7.26)	(-9.01)						
TANGI	-3.815***	-3.816***						
	(-7.27)	(-9.01)						
TANGF	-4.397***	-4.333***	-2.863***	-2.668***	-3.256***	-2.437***	-3.457***	-2.573***
	(-15.22)	(-19.03)	(-7.95)	(-11.47)	(-7.92)	(-8.95)	(-8.15)	(-9.64)

RDDUM	-0.162*	-0.119	-0.121	-0.091				
	(-1.76)	(-1.59)	(-1.35)	(-1.20)				
RD					0.570	1.551	0.982	1.477
					(0.34)	(1.38)	(0.58)	(1.28)
PROFIT	0.952*	0.076	-0.056	-0.816	0.214	-0.003		
	(1.79)	(0.18)	(-0.09)	(-1.45)	(0.24)	(0.00)		
OPCFL							1.563***	1.708***
							(3.13)	(3.47)
DIVDUM	0.034	0.015	0.107*	0.083				
	(0.57)	(0.27)	(1.70)	(1.31)				
DIVYIELD					2.095	2.62	2.522	2.544
					(0.75)	(0.99)	(0.94)	(0.98)
1/ZSCORE	-0.506**	-0.253						
	(-2.07)	(-1.22)						
MTBR	0.037*	0.022	-0.010	-0.013	-0.019	-0.001	-0.012	-0.005
	(1.94)	(1.36)	(-0.60)	(-0.76)	(-0.91)	(-0.05)	(-0.59)	(-0.33)
CASHCC	-0.174	-0.373	-2.581***	-2.295***				
	(-0.22)	(-0.59)	(-4.81)	(-4.40)				
Constant	5.466***	2.905***	1.704**	-0.640	3.291**	-0.220	2.827**	-0.219
	(8.04)	(7.41)	(2.63)	(-1.61)	(2.60)	(-0.39)	(2.10)	(-0.41)
R^2 within	0.387	0.369	0.224	0.203	0.208	0.187	0.241	0.224
R^2 between	0.427	0.647	0.229	0.469	0.197	0.399	0.239	0.387
R^2 overall	0.392	0.557	0.203	0.363	0.173	0.324	0.219	0.337
Observ.	916	916	989	989	851	851	828	828
Groups	143	143	146	146	135	135	134	134
Hausman test		91.25***		-203.24		27.75**		21.38

This table presents the results from fixed effects (FE) and random effects (RE) panel regressions. All variables are truncated at the 1 percent and 99 percent levels. In all columns, *LNCASHN* is the dependent variable; it is computed as the natural logarithm of the ratio of cash and equivalents and net assets (i.e., total assets minus cash). All explanatory variables are explained in section 3.1. The last row shows the value of a HAUSMAN (1978) test statistic. In parentheses are the *t*-statistics and the *z*-statistics for the fixed effects and random effects estimators, respectively. Year fixed effects are included in all specifications. ***, ** and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively. Standard errors are corrected for heteroscedasticity using the WHITE (1980) methodology. The coefficient of *CASHCC* is multiplied by a factor 1'000. N denotes the number of firm-year observations.

3.3 Dynamic panel data estimation

OPLER et al. (1999) examine whether cash holdings are mean-reverting. They document negative autocorrelation and conclude that the hypothesis of a target ratio's existence cannot be rejected. They emphasize, however, that mean reversion is not inconsistent with a financing hierarchy model, where cash holdings are *not* actively managed but the change in cash rather depends on the change in the growth of internal resources. If the growth of internal resources is negatively autocorrelated (e.g., because of business cycle fluctuations), then the cash holdings will also be autocorrelated. BRUINSHOOFD and KOOL (2004) investigate Dutch firms and interpret their results as being consistent with long-run liquidity targets. Depending on the empirical methodology, they document that the rates of annual target convergence range from 20 percent to over 60 percent. To some extent, these results support the dynamic nature of the cash-holding decision, which is characterized by a trade-off between the costs of divergence from the target and the costs of adjustment.

In this section we extend the static cash-holding model and formulate a partial (dynamic) adjustment model. An implicit assumption in the static model is that a firm can instantaneously adjust towards the target cash level in response to changes in firm-specific characteristics and/or random shocks. In the presence of adjustment costs, however, it may not be optimal for a firm to immediately adjust towards the target cash level [13]. Costly adjustment leads to a delay in the adjustment process, and therefore a firm's observed cash ratio is not necessarily identical to the desired cash ratio. Following OZKAN and OZKAN (2004), we estimate a dynamic panel model, where the first lag of the dependent variable (i.e., the natural logarithm of the cash ratio) is used as an explanatory variable [14]. In general, this class of model allows an analysis of whether current behaviour depends upon past behaviour. In our context the specific model describes the dynamics of cash holdings by estimating the speed of adjustment towards an endogenously determined target cash ratio.

As in OZKAN and OZKAN (2004), we assume that an unobservable target cash ratio exists, denoted as $CASH^*$, which is a function of firm-specific characteristics and a disturbance term. Specifically, the target cash ratio of firm i at time t is modelled as follows:

$$(1) \qquad CASH_{it}^{*} = \sum_{k} \beta_k x_{kit} + \varepsilon_{it} ,$$

where there are k firm-specific characteristics. Actual and target cash ratios may diverge, and during each period firms partially adjust towards their target cash ratio. The speed of this adjustment process is captured by a constant adjustment coefficient, denoted as λ. The adjustment dynamics are modelled as:

$$(2) \qquad CASH_{it} - CASH_{i,t-1} = \lambda\left(CASH_{it}^{*} - CASH_{i,t-1}\right).$$

Plugging equation (1) for the (time-varying) target cash ratio into equation (2) for the adjustment dynamics delivers the following expression for a firm's actual cash ratio at time t as a function of the lagged cash ratio at time $t-1$ and contemporaneous firm-specific variables:

$$(3) \qquad CASH_{it} = \gamma_0 CASH_{i,t-1} + \sum_{k} \gamma_k x_{kit} + \alpha_i + \alpha_t + \mu_{it} ,$$

with $\gamma_0 = 1 - \lambda$, $\gamma_k = \lambda\beta_k$, and $\mu_{it} = \lambda\varepsilon_{it}$, and where α_i and α_t denote firm-specific and time-specific effects, respectively. Most important, the estimated value of $\lambda = 1 - \gamma_0$ measures the speed of adjustment towards an endogenous (time-varying) target cash ratio, computed as $\sum_k \gamma_k x_{kit}$. An adjustment speed of 1 indicates that firms instantaneously adjust towards their target cash ratio, i.e., $CASH_{it} = CASH_{i,t}^{*}$. In contrast, an adjustment speed of 0 implies excessively high adjustment costs, preventing firms from making adjustments in their cash holdings, i.e., $CASH_{it} = CASH_{i,t-1}$ [15].

In a dynamic panel model a problem arises from the inclusion of lagged dependent variables. Since $CASH_{it}$ is a function of α_i, it immediately follows that $CASH_{i,t-1}$ is also a function of α_i. Therefore, $CASH_{i,t-1}$, a regressor in equation (3), will be correlated with the error term, implying that an ordinary least squares estimator is biased and inconsistent. In addition, shocks that jointly affect the cash ratio and the explanatory variables could lead to endogeneity problems due to an omitted variables bias. To address these problems, we use ARELLANO and BOND's (1991) Generalized Method of Moment (GMM) dynamic panel estimator [16]. They show that first differencing the dynamic model in equation (3) produces an equation that can be estimated by instrumental variables. By using all possible lagged vectors of the right-side variables as instruments, their methodology exploits the orthogonality conditions that exist between these instrument variables and the disturbance term of the differenced equation. The resulting GMM estimator is asymptotically efficient and accounts for arbitrary heteroscedasticity. However, estimation problems arise from autocorrelation in the residuals. While AR(1) autocorrelation of the error term in first differences does not affect the properties of the GMM estimator, AR(2) autocorrelation leads to inconsistent estimators.

Dynamic panel estimators have one-step and two-step variants, depending on the iteration process involving the quadratic form of the weighting matrix and the coefficient estimates. In our estimations we encounter significant second-order error correlations based on the one-step GMM estimator, implying that the corresponding coefficients are inconsistent. Theoretically, two-step estimators are asymptotically more efficient than one-step estimators, but their estimates of the standard errors are biased downward in small samples (ARELLANO and BOND, 1991). To address this issue, we employ the two-step procedure and apply the finite sample correction to the covariance matrix, as recently suggested by WINDMEIJER (2005).

Table 5 shows the estimation results for the dynamic panel model, in which we treat all explanatory variables as exogenous (except the lagged cash ratio). For all regression specifications, we present HANSEN's (1982) chi-square test statistic for the null hypothesis that the dynamic model's overidentifying restrictions are valid, i.e., that the estimated orthogonality conditions are sufficiently close to zero ("goodness-of-fit"). The null hypothesis cannot be rejected in any of the four model specifications, thus supporting the choice of all lagged dependent variables from the second lag onward as valid instruments.

Table 5: Dynamic panel data estimation results

	(1)	(2)	(3)	(4)
		Dependent variable:		
	CASH	***CASH***	***LNCASHN***	***LNCASHN***
CASH(t-1)	0.624***	0.646***	0.502***	0.541***
	(8.12)	(10.10)	(4.68)	(4.97)
LSIZE2	-0.001	0.000	0.008	0.023
	(-0.42)	(0.09)	(0.29)	(0.80)
LEV	-0.298**	-0.266***	-2.683**	-1.673
	(-2.58)	(-2.58)	(-2.44)	(-1.60)
LEV^2	0.321**	0.344**	1.829	1.223
	(2.01)	(2.34)	(1.05)	(0.72)
TANGF	-0.064**	-0.063***	-0.920**	-0.885***
	(-2.94)	(-3.19)	(-2.76)	(-2.83)

RD	0.163*	0.173*	0.953	0.876
	(1.76)	(1.85)	(1.06)	(0.96)
PROFIT	-0.179**		-1.154	
	(-2.12)		(-1.55)	
OPCFL		0.350***		3.547***
		(6.15)		(6.64)
DIVYIELD	0.529	0.427	5.273*	3.060
	(1.33)	(1.26)	(1.86)	(1.19)
MTBR	0.003	-0.002	0.030	-0.009
	(1.42)	(-0.76)	(1.60)	(-0.51)
Constant	0.134**	0.065*	-0.256	-1.143**
	(2.82)	(1.71)	(-0.55)	(-2.53)
Correl. 2	-0.811	-1.001	-0.946	-0.849
Hansen test	41.314	38.558	41.470	42.160
N	766	751	764	749
Groups	132	131	132	131

This table presents the results from two-step dynamic Generalized Method of Moments (GMM) estimation. All variables are truncated at the 1 percent and 99 percent levels. *CASH* is calculated as the ratio of cash and cash equivalents to total assets, and *LNCASHN* is the natural logarithm of the ratio of cash and equivalents and net assets (i.e., total assets minus cash). In parentheses are the *t*-statistics. All explanatory variables are explained in section 3.1. Correl. 2 shows the ARELLANO-BOND (1991) test statistic for the null hypothesis that there is no second-order correlation in the residuals, and the HANSEN (1982) test indicates the chi-square test statistic for the null hypothesis that all estimated orthogonality conditions are jointly equal to zero (goodness-of-fit). ***, ** and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively. N denotes the number of firm-year observations.

As shown in table 5, the estimated speed of adjustment coefficient for Swiss firms, $\lambda = 1 - \gamma_0$, ranges between 0.35 and 0.50. The strong statistical significance of the estimated coefficients emphasizes that it is important to take the dynamic characteristics of cash holdings into account. With regard to the magnitude of the estimated coefficient, we find that the speed of adjustment of Swiss firms is, on average, lower than in other countries. For example, OZKAN and OZKAN report an estimated annual adjustment coefficient of 0.6 for U.K. firms. GUNEY et al. (2003) confirm these results for a sample of firms from the U.K., Japan, France, and Germany. Japanese and German firms exhibit the lowest speed of adjustment, which could be explained by their close ties to banks (relationship banking). COUDERC (2005) also documents differences in the adjustment coefficients across countries. He estimates higher adjustment coefficients for the U.S. and Canada (over 0.6) than for Germany and France (roughly 0.5). On the one hand, the low adjustment speed of Swiss firms suggests that the cost of being off target is lower in Switzerland than in Anglo-Saxon countries. On the other hand, it may suggest that adjustment costs are relatively more expensive in Switzerland than in other countries. In general, the slow speed of adjustment of Swiss firms seems consistent with their propensity to hold high levels of cash. Firms with slow adjustment towards their target cash ratio must hold higher cash reserves in order to avoid cash shortfalls that require costly adjustments. Another explanation builds on Swiss firms' dependence on banks for external financing and the accompanying easy credit policy of domestic banks during the last decade. Banks serve as monitors and, therefore, firms can adjust slowly towards a tar-

get cash level without incurring high agency costs. Moreover, as has been argued in section 3.1 above, Switzerland did not experience a booming economy during our sample period. Internal funds were generally sufficient to finance all capital expenditures, and – with only a few good investment opportunities appearing (and a generally low probability to fall short of cash) – it was not costly to deviate from the target cash ratio.

In addition to the estimates for the adjustment coefficients, table 5 also presents the estimates for the determinants of the (endogenous) target cash ratio. Most of the results are qualitatively similar to those in tables 3 and 4, albeit somewhat less pronounced. For example, the impact of firm size on cash holdings is no longer significantly estimated. There are three additional noteworthy changes. First, our regression models seem to indicate that the operating profit (*PROFIT*) negatively impacts cash holdings, but in only one of the specifications the coefficient is significant. If we consider the operating cash flows (*OPCFL*) as a proxy for profitability, however, we still encounter the positive significant influence on cash holdings. Second, in one specification we document a positive influence of *DIVYIELD* on cash holdings, i.e., firms that pay relatively higher dividends tend to hold more cash. This result confirms our previous finding that dividend payers do not view dividends as a source of finance but rather avoid a dividend curtailment due to costly signalling. Third, there is weak evidence that increased research and development activities (*RD*) lead to larger cash holdings, as could be hypothesized by theory.

4 Corporate governance and cash holdings

In this section we analyze the influence of firm-level corporate governance structures on cash holdings. Because we do not have time-series data for most of the relevant corporate governance variables, we run simple cross-sectional regressions. As the dependent variable we use the natural logarithm of our firms' net cash ratios (*LNCASHN*) as of year-end 2003. To account for potential endogenity problems due to reverse causality, the firm-specific variables described in section 2 above are taken as four-year averages from 1999 to 2002 (RAJAN and ZINGALES, 1995). In simple cross-sectional regressions, we can also add time-constant variables that would have been eliminated in fixed effects regressions. Therefore, we include the standard deviation of operating cash flows normalized by total assets (*CFV*). To compute the standard deviation of operating cash flows, we use data for at least five consecutive years before 2003 (with a maximum of eight years). Most important, we include several corporate governance variables as explanatory variables [17]. Due to data availability, these variables are measured as of year-end 2003, thus explaining the slightly different sample period compared to the panel regressions in section 3. Nevertheless, the corporate governance variables are not available for all sample firms, and the cash ratio is truncated at the 1 percent and 99 percent levels. Table 6 provides a data description of the remaining 114 firms.

Table 6: Descriptive statistics

	Mean	Max.	0.75 quantile	Median	0.25 quantile	Min.	Standard deviation
CASH	0.148	0.437	0.225	0.121	0.065	0.008	0.103
LNCASHN	-2.070	-0.255	-1.240	-1.980	-2.670	-4.860	1.030
LNSIZE	13.100	18.900	14.100	13.000	11.800	9.730	1.900
LEV	0.257	0.532	0.362	0.263	0.146	0.006	0.131
LEV_2	0.088	0.346	0.133	0.073	0.027	0.000	0.074
TANGF	0.358	0.935	0.449	0.339	0.200	0.065	0.200
DIVYIELD	0.018	0.089	0.027	0.016	0.007	0.000	0.014
MTBV	2.650	13.000	3.060	1.760	1.130	0.431	2.410
OPCFL	0.081	0.264	0.110	0.083	0.055	-0.201	0.055
CFV	0.046	0.240	0.056	0.035	0.024	0.012	0.038
MOWNER	0.173	0.680	0.342	0.055	0.004	0.000	0.209
CEOCOB	0.167	1.000	0.000	0.000	0.000	0.000	0.374
LSHARE	0.340	0.918	0.545	0.279	0.120	0.000	0.248
BLOCK	0.221	0.920	0.338	0.151	0.000	0.000	0.246
SCAT	0.298	1.000	1.000	0.000	0.000	0.000	0.460

BSIZE	6.750	14.000	8.000	6.500	5.000	3.000	2.140

This table shows the descriptive statistics of the 114 non-financial Swiss firms that are used in our cross-sectional regressions. *MOWNER* denotes the percentage of shares held by a firm's managers. *CEOCOB* is a dummy variable which takes on the value of one if the CEO simultaneously acts as the COB, and zero else. *LSHARE* denotes the percentage of voting rights of the largest shareholder. *BLOCK* is the percentage of total voting rights of shareholders (that are not in the management, on the board, or related to such insiders) with more than 5 percent voting rights. *SCAT* takes on the value of 1 if a company has more than one share category, and zero else. *BSIZE* is the number of representatives on the board. All corporate governance variables are observed as of year-end 2003. All other explanatory (firm-specific) variables are taken as four year averages from 1999 to 2002 and are explained in section 3.1. The cash ratio (*CASH* and *LNCASHN*) is observed as of year-end 2003 and truncated at the 1 percent and 99 percent levels.

Our first corporate governance variable is the total shareholding of a firm's management (cumulated voting rights, including board members) as a percentage of total shares, denoted as *MOWNER*. To the extent that holding cash is costly, and assuming that managerial ownership aligns the interests of managers with those of shareholders (JENSEN and MECKLING, 1976), one would expect a negative relationship between managerial shareholdings and cash holdings. In addition to this incentive alignment effect, lower expected agency costs increase a firm's ability to raise external funds and reduce the need to hold large cash reserves. With very high managerial shareholdings, however, managers may eventually become entrenched as they gain control over the firm and do not have to fear active monitoring by outside shareholders (JENSEN, 1986). This entrenchment effect – in combination with the incentive alignment effect – implies a U-shaped relationship between managerial ownership and cash holdings. As in OZKAN and OZKAN (2004), we test this hypothesis by including a quadratic term of *MOWNER* in our regressions. To account for higher non-linearities, we also include a cubic term.

An additional hypothesis is that high managerial ownership makes managers risk-averse (FAMA and JENSEN, 1983). To test this notion, we also include the absolute value of managerial shareholdings (i.e., *MOWNER* multiplied by *LNSIZE*) as an additional explanatory variable. If risk aversion induces owner-managers to hold more cash, one would expect a positive relationship between the interaction term *MOWNER*LNSIZE* and cash holdings.

To capture a firm's ownership structure, we also include the percentage of voting rights of the largest shareholder, denoted as *LSHARE*. In addition, the variable *BLOCK* is the percentage of cumulated voting rights exercised by true outside blockholders, i.e., non-group listed companies, mutual funds, and pension funds with voting rights exceeding 5 percent. One would expect large outside blockholders to be in a position to enforce the interests of shareholders and force firms to reduce excessive cash holdings. The relationship between the largest shareholder's ownership stake in the firm and cash holdings can be positive or negative, depending on whether he or she gains private benefits from holding cash or exerts his or her control function (to the benefit of minority shareholder), respectively. Deviations from the one share-one vote principle also offer opportunities to expropriate minority shareholders, and one possibility is to hold excess cash. Therefore, we include a dummy variable labelled *SCAT*, which takes on the value of one if a firm has more then one share category, and zero otherwise.

To test whether the structure of the board of directors affects a firm's cash holdings, we include a dummy variable, denoted as *CEOCBO*, which is one if the CEO simultaneously acts as the CBO, and zero otherwise. A testable hypothesis is that firms with dual-responsibility CEOs serve the interests of the management team (e.g., DAHYA and TRAVLOS, 2000), and one way to protect the team's position is to hold excessive cash. We also test whether larger boards with a presumably less effective decision-making process (JENSEN, 1983; YERMACK, 1996) hold more cash. The variable *BSIZE* measures the number of directors serving on the board.

Table 7 presents our results. All reported standard errors are corrected for heteroscedasticity using the WHITE (1980) covariance matrix. The negative coefficient on *MOWNER* indicates that managers who own a high percentage of a firm's shares have an incentive to reduce cash holding. This negative relationship between managerial ownership and cash holdings could be explained by an incentive alignment effect. Although the estimated coefficient on *MOWNER^2* is positive, indicating a U-shaped relationship as suggested by theory, it is not statistically significant. The cubic term *MOWNER^3* is also estimated to be insignificant. However, the coefficient on the interaction term *MOWNER*LNSIZE* is significantly positive, indicating that managers' risk aversion increases with higher absolute values of their ownership stakes, inducing them to hold higher cash reserves. Overall, therefore, managerial ownership influences the cash ratio in two opposite directions. On the one hand, a higher percentage of managerial ownership alleviates the conflict of interest between shareholders and managers, implying lower cash ratios. On the other hand, cash holdings increase when the absolute value of managerial ownership is very high.

These results contradict previous findings for U.S. firms. In an early study PAPAIOANNOU et al. (1992) conclude that there is no significant influence from managerial ownership on U.S. firms' cash holdings. OPLER et al. (1999) document only a marginal impact from managerial ownership on the amount of cash holdings of U.S. firms. In contrast, OZKAN and OZKAN (2004) also report a non-monotonic relationship for U.K. firms. Cash holdings first decrease until managerial ownership increases up to 24 percent, possibly indicating that the alignment effect dominates the entrenchment effect. Beyond this point cash holdings rise until managerial ownership increases to 64 percent, and then it falls again at higher levels of managerial ownership.

Table 7: Cross-sectional regression results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Dependent variable: *LNCASHN*			
LNSIZE	0.058	0.058	0.060	0.042	0.042	0.044	0.022
	(1.02)	(0.99)	(1.00)	(0.75)	(0.73)	(0.75)	(0.28)
LEV	-	-	-	-	-	-	-
	6.217***	6.222***	6.149***	6.162***	6.166***	6.094***	5.849***
	(-3.24)	(-3.10)	(-3.09)	(-3.20)	(-3.06)	(-3.05)	(-2.96)
LEV_2	6.531*	6.539*	6.418*	6.559*	6.565*	6.446*	5.791
	(1.94)	(1.88)	(1.86)	(1.97)	(1.91)	(1.89)	(1.62)
DIVYIELD	0.941	0.941	1.259	1.270	1.269	1.578	-0.393
	(0.18)	(0.18)	(0.23)	(0.24)	(0.24)	(0.30)	(-0.06)
TANGF	-0.877	-0.877	-0.874	-0.796	-0.796	-0.793	-0.789
	(-1.35)	(-1.35)	(-1.35)	(-1.22)	(-1.22)	(-1.22)	(-1.28)
MTBV	0.039	0.039	0.042	0.036	0.036	0.039	0.061
	(1.12)	(1.04)	(1.14)	(1.03)	(0.95)	(1.04)	(1.64)
OPCFL	1.930	1.928	1.999	2.095	2.094	2.161	1.922
	(1.29)	(1.27)	(1.32)	(1.40)	(1.38)	(1.43)	(1.22)
CFV	3.819*	3.817*	3.935*	4.188*	4.186*	4.300*	4.239*
	(1.74)	(1.71)	(1.72)	(1.85)	(1.82)	(1.83)	(1.83)

MOWNER	-4.492*	-4.474	-2.768	-4.937**	-4.924	-3.258	-3.474
	(-1.91)	(-1.58)	(-0.69)	(-1.99)	(-1.66)	(-0.79)	(-0.78)
MOWNER^2		-0.040	-6.973		-0.029	-6.795	-4.020
		(-0.02)	(-0.56)		(-0.01)	(-0.54)	(-0.32)
MOWNER^3			7.613			7.430	5.256
			(0.59)			(0.57)	(0.41)
MOWNER*LNSIZE	0.312*	0.313*	0.295*	0.349*	0.349*	0.332*	0.269
	(1.80)	(1.82)	(1.77)	(1.88)	(1.90)	(1.86)	(1.52)
CEOCOB				0.328*	0.328*	0.327	
				(1.67)	(1.66)	(1.64)	
BSIZE							0.042
							(0.75)
LSHARE							-0.207
							(-0.35)
BLOCK							-0.117
							(-0.21)
SCAT							0.258
							(1.01)
Constant	-1.875**	-1.876**	-1.956**	-1.794**	-1.795**	-1.874**	-1.749*
	(-2.17)	(-2.15)	(-2.16)	(-2.11)	(-2.09)	(-2.11)	(-1.70)
R^2	0.417	0.417	0.418	0.429	0.429	0.430	0.431
Adj. R^2	0.360	0.354	0.349	0.367	0.361	0.356	0.338
N	114	114	114	114	114	114	114

This table shows the results from cross-section regressions. *LNCASHN* is the dependent variable; it is computed as the natural logarithm of the ratio of cash and equivalents and net assets (i.e., total assets minus cash) and truncated at the 1 percent and 99 percent levels. All explanatory variables are explained in sections 3.1 and 4. The corporate governance variables are observed as of year-end 2003, and all other explanatory variables are taken as four year averages from 1999 to 2002. In parentheses are the *t*-statistics. ***, ** and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively. Standard errors are corrected for heteroscedasticity using the WHITE (1980) methodology. N denotes the number of observations.

Our estimations further reveal that CEO duality leads to significantly higher cash holdings. The magnitude of the estimated coefficient on *CEOCOB* indicates that, on average, the cash reserves of a firm with a dual CEO exceeds the (net) cash ratio of a firm with separated functions of CEO and COB by more than 30 percent. This result seems to support the hypothesis that one way for an insider-dominated board to protect its own position is to hold more cash. However, OZKAN and OZKAN (2004) cannot detect a significance of dual CEOs on corporate cash holdings.

For all other corporate governance variables, i.e., board size, ownership stakes of the largest shareholder and outside blockholders, and types of share categories, we cannot detect a significant relationship with cash holdings. These findings are in line with OZKAN and OZKAN (2004). In contrast, KUSNADI (2004) analyzes Singaporean firms and suggests that board size, insider dominance on the board, and outside blockholders significantly influence the cash ratio. IONA et al. (2004) simultaneously analyze cash reserves and

leverage. They treat a firm as financially conservative if it has both low leverage and high cash reserves at the same time. Their results suggest that managerial ownership, board composition, and, to some extent, ownership concentration influence the likelihood of firms to adopt a conservative financial policy.

To test the robustness of our results due to the small sample size, we truncate the dependent variable at the 5 percent tails because a few outliers with very high cash holdings could strongly affect the results. Our main findings remain unchanged, however. The coefficient of the variable *MOWNER* is even significant in one additional specification and the coefficient of the variable *CEOCOB* is significant in every specification.

Compared to the panel regression estimations in section 3, our cross-sectional regression results remain qualitatively similar, albeit less pronounced. For example, we document the same relationship for the leverage and the squared leverage as in the panel regression. A noteworthy exception is the insignificant relationship between asset tangibility and cash holdings [18]. Most important, however, our results reveal that firms with more volatile cash flows tend to hold more cash. This result is consistent with the findings by JOHN (1993) and KIM et al. (1998).

5 Conclusions

We examine the holdings of cash and cash equivalents of 156 Swiss non-financial firms over the 1995 to 2004 period. A main result of our analysis is that the median Swiss firm has substantially higher cash reserves than firms from most other countries. We also observe significant influences from various firm-specific variables on cash holdings, and our findings support several hypotheses derived from theory. According to the transaction cost motive, firms face a trade-off between the costs and benefits of holding cash. The strong negative relationship between asset tangibility and the cash ratio indicates that firms with assets that can easily be liquidated accumulate less cash to minimize the opportunity costs of liquidity. The observation that firms with higher leverage tend to hold less cash supports the idea that the opportunity costs of holding cash increase with leverage. In addition, we find some evidence for the hypothesis that large firms hold less cash due to economies of scale in security issuances.

Other results also support the precautionary motive in the literature. The negative relationship between leverage and cash holdings is consistent with the pecking order theory and increased monitoring, but the positive coefficient on the squared leverage coefficient indicates that firms tend to hold more cash when the probability of financial distress increases. A positive relationship between operating cash flows and cash holdings also supports the pecking order theory. Hence, the results do not indicate that profitability substitutes for cash. In contrast, we cannot detect a significant relationship between the market-to-book ratio and cash holdings. The market-to-book ratio is a proxy for both growth opportunities and/or the importance of adverse selection costs, leading to competing hypotheses in a pecking order framework. Our regression models cannot disentangle the opposing forces.

Based on the precautionary motive, one would expect a positive relationship because growth firms will avoid foregoing valuable investment opportunities due to cash shortages. Finally, we document a moderate positive relationship between dividend payments and cash holdings, probably reflecting firms' reluctance to cut dividend payments.

In addition to fundamental variable, we also investigate the role of corporate governance structures on the amount of cash holdings. While most of our corporate governance variables do not have a significant impact on the cash ratio, our results indicate that managerial shareholdings affect cash holdings in two ways. First, a higher percentage of managerial ownership reduces a firm's cash ratio. Second, however, the cash ratio increases when the absolute value of managerial shareholdings in a firm increases. The two opposing effects can be interpreted as an alignment effect and a risk-aversion effect, respectively. Furthermore, a firm's cash ratio is much higher if the CEO simultaneously serves as the COB, suggesting increased problems from an agency perspective under CEO duality.

Finally, we analyze Swiss firms' speed of adjustment towards an endogenous target cash ratio. The estimated adjustment coefficient from dynamic panel models varies between 0.35 and 0.5, indicating that Swiss firms adjust more slowly towards their target cash ratio than firms in other countries. We suspect that the most reasonable explanations are based on the strong influence of banks in Switzerland and/or the unfavourable economic conditions during our sample period that entail low costs of deviation from the target.

Conservative financial policies are often criticised as serving the interests of managers rather than those of shareholders. Therefore, two questions for further research arise. First, what happens to excess cash? Second, does excess cash negatively impact firm valuation and/or firm performance? HARFORD (1999) and

HARFORD et al. (2004) conclude that cash-rich U.S. firms are more likely to make value-decreasing acquisitions. In contrast, MIKKELSON and PARTCH (2003) suggest that high cash reserves promote investments without hindering corporate performance. Weighing the benefits (e.g., avoiding transaction and adverse selection costs) and costs (e.g., double-taxation and managerial entrenchment) of cash, FAULKENDER and WANG (2006) estimate that the average marginal value of cash across all firms is $0.94. However, this value declines with larger cash holdings, higher leverage, and better access to capital markets [19]. Moreover, KALCHEVA and LINS (2004) as well as DITTMAR and MAHRT-SMITH (2005) provide evidence that the value effects depend on corporate governance structures. We leave it for future research to explore whether cash holdings have positive or negative valuation impacts on Swiss firms.

ENDNOTES

[1] In what follows, the expressions cash, cash holdings, cash reserves and liquidity are synonymously used for cash and equivalents.

[2] JANI et al. (2004) analyze the cash holdings of a sample of 128 Swiss firms for the period 1990-2000. They find evidence for both the trade-off theory and the pecking order. Moreover, they document that ownership structure impacts the amount of cash holdings.

[3] In the panel regression model (table 3) our unbalanced panel starts with 72 firms in 1994. During the sample period, however, the yearly number of firms varies between 72 and 122. The total number of firms in our sample is 156.

[4] See Credit Suisse Economic Briefing 39 (2005), p. 24f.

[5] DITTMAR et al. (2003) also employ this second definition of the cash ratio. With this measure, for example, the median Swiss firm's cash ratio is twice as high as that of U.K. firms

[6] BASKIN (1987) looks at cash holdings from a game theoretical point of view. He presents evidence for the hypothesis that cash reserves can be used to signal a firm's commitment to retaliate against market encroachment.

[7] To test the robustness of this definition, we additionally use another definition of the Z-score (1/*ZSCORE2*).We employ the inverse of the Altman's original Z-score by also adding the liquidation measure, i.e., the ratio of the working capital to total assets multiplied with the factor 1.4 (ALTMAN, 1968).

[8] Due to data limitations, we compute *CASHCC* without accruals and taxes.

[9] A problem arises if leverage and cash holdings are determined simultaneously within a firm's (unobservable) financial strategy. In this case, leverage would be an endogenous regressor variable, leading to biased and inconsistent coefficient estimates. However, the problems induced by unobserved and time-constant common factors can be alleviated by using panel data and calculating fixed-effects estimators (e.g., HIMMELBERG et al., 1999; BÖRSCH-SUPAN and KÖKE, 2002).

[10] This notion also implies that the marginal value of cash to shareholders should increase as leverage decreases (e.g., FAULKENDER and WANG, 2005).

[11] The estimated coefficient of the Z-score becomes higher and the t-value increases if we use the other definition of Z-score (1/*ZSCORE2*). The other coefficients of the regression are not affected.

[12] The correlation coefficient between the market-to-book ratio and the operating cash flow is 0.24 in our sample (see table 2).

[13] For a discussion in the context of optimal capital structure, see MYERS (1984) and FISCHER et al. (1989).

[14] Dynamic adjustment models have already been used in the capital structure literature (e.g., DE MIGUEL and PINDADO, 2001; DROBETZ and FIX, 2005).

[15] Note that firms adjust towards a time-varying target. In fact, a firm could passively adjust towards the target cash ratio if it does not change its cash holdings, but rather the target cash ratio changes towards the actual cash ratio. For a model with a time-varying adjustment speed, see DROBETZ and WANZENRIED (2005).

[16] See also OZKAN and OZKAN (2004) and COUDERC (2005).

[17] In general, all corporate governance variables are measured as of year-end 2003. However, for a small number of firms that did not disclose the necessary information in 2003, the 2004 values are used instead.

[18] We can rule out multicollinearity as an explanation. In results not reported here, we find that the correlations between the corporate governance variables are generally low (see BEINER et al. (2006) for details). However, using lagged regressor variables cannot account for a potential endogeneity bias induced from unobserved factors (see BÖRSCH-SUPAN and KÖKE, 2002).

[19] COUDERC (2005) investigates the influence of excessive cash holdings on firm performance with a sample of firms from Canada, France, Germany, the U.K., and the U.S. His results also suggest that cash-rich firms perform worse.

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